SHSAT Math Topics
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Generally: rates/ratios/proportions, geometry, algebra, data analysis/statistics, probability, mean

7th: time, mean, rates, proportions and ratios, slope, linear equations, rational numbers, perimeter, area, volume, circumference, "percent" problems including discounts/taxes/etc, counting, fractions, decimals (including repeating), geometrically similar object and their scaling, number line including scaling and negative units, absolute value, adding and subtracting involving negative and positives, algebra involving one variable of various sorts, rules and truisms involving intersecting lines, circles/triangles/quadrilaterals/polygons/cubes/right prisms, angles and their sums/interior/exterior/within polygons, parallel lines, population inferences and X-way tables, word problems, multi-step solutions, chance and probability including factorials, from lists and data sets, unit conversions, parallelogram, trapezoid, octagon, rectangle, square, order of operations, numeric patterns, prime number, prime factorization, factors, GCF, LCM, mixed fractions, fraction ordering, conversion to/from decimals/fractions

8th: graphing/slope/intercept/distance, outliers, number line, FOIL, solving linear equations, inequalities, shaded regions, using functions including comparing/rate of change/interpreting/input/output, geometric similarity and congruence, Pythagorean Theorem, right triangles, translations/rotations/reflections/dilations/clockwise/counterclockwise/90/180/270, more slope/coordinates/grids/distances, more cones/cylinders/spheres/volume, radical numbers, exponents, square and cube roots, scientific and decimal notations and conversions thereof, percent involving interest

Also throughout is reemphasize of algebra and other mathematical concepts learned in all years. You're also expected to do out of the box thinking to address "novel situations."

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SHSAT 8th & 9th Grade Math Formulas

2D Shapes Formulas

Note: All units are squared, for example: $2\ in^2$

Circumference of a Circle: $2\pi r$ $(r\ = radius)$

Area of a Circle: πr^2 $(r = radius)$

Area of a Triangle: $bh\frac{1}{2}$ $(b = base,\ h = height)$

Area of a Square / Rectangle: $l \bullet w$ $(l = length,\ w = width)$

Find the Area of a Square (Given Only Diagonal): $\frac{d^2}{2}$

Diagonal of a Square: $d = s\sqrt{2}$ $\quad (d = diagonal,\ s = side)$

Diagonal of a Rectangle: $d = \sqrt{l^2 + w^2}$ $\quad (l = length,\ w = width)$

Area of a Trapezoid: $h(\frac{a+b}{2})$ $(h\ = height,\ a = base\ 1,\ b = base\ 2)$

Area of a Rhombus: $\frac{p+q}{2}(p = point\ 1,\ q = point\ 2)$

Area of a Quadrilateral:
$\frac{1}{2}d\cdot\ (h_{\ 1} + h_{\ 2})$ $\quad (d = diagonal,\ h_{\ 1} = height\ 1,\ h_{\ 2} = height\ 2)$

2D Polygon Degrees: $180(n - 2)$ $(n = \#\ of\ sides)$

3D Shapes Formulas

Note: Surface Area units are squared, for example: $25\ cm^2$

Note #2: Volume units are cubed, for example: $100\ yd^3$

Volume of a Sphere: $\frac{4}{3}\pi r^3 (r = radius)$

Volume of a Triangular Pyramid:
$\frac{1}{3}Ah\ (A = area\ of\ triangle\ base,\ h = height)$

Volume of a Triangular Prism: $(\frac{1}{2}bh)l$
$(b = base,\ h = height,\ l = length)$

Volume of a Cube: $V = s^3\ (s = side)$

Diagonal of a Cube: $d = s\sqrt{3}$ $(d = diagonal,\ s = side)$

Diagonal of a Cube / Rectangular Prism (Only with each different values of length, width, and height): $a^2 + b^2 + c^2 = d^2$

Volume of a Rectangular Prism:
$V = lwh\ (l = length,\ w = width,\ h = height)$

Volume of a Cone: $\pi r^2 \frac{h}{3} (r = radius,\ h = height)$

Volume of a Cylinder: $\pi r^2 h\ (r = radius,\ h = height)$

Surface Area of a Sphere: $SA = 4\pi r^2 (r = radius)$

Surface Area of a Triangular Pyramid:
$SA = BA + \frac{1}{2}(P + H)\ (BA = Base\ Area,\ P = Perimeter)$

Surface Area of a Triangular Prism: $SA = bh + h(s_1 + s_2 + s_3)$

Surface Area of a Cube: $6s^2\ (s = side)$

Surface Area of a Rectangular Prism: $2(wl + hl + hw)$

Surface Area of a Cone: $\pi rs + \pi r^2\ (r = radius,\ s = slant\ height)$

Surface Area of a Cylinder: $2\pi rh + 2\pi r^2$

Diagonal of a Cube:

<u>Graphing Formulas</u>

Slope Intercept Form: $y = mx + b\ (m = slope,\ b = y - intercept)$

Slope Formula: $m = \frac{y_2 - y_1}{x_2 - x_1}$

Midpoint Formula: $\left(\frac{x_1 + x_2}{2} + \frac{y_1 + y_2}{2}\right)$

Proportional Graph Formula: $k = \frac{y}{x}$

Functions - Range and Domain:

$f(x) + n\ (positive\ y)$

$f(x) - n\ (negative\ y)$

$f(x + n)\ (positive\ x)$

$f(x - n)\ (negative\ x)$

Right Triangle Formulas

Pythagorean Theorem: $a^2 + b^2 = c^2$

Pythagorean Theorem (Alternative): $(a + b)^2 - 2ab = c^2$

(Only used when you get something like this: $a + b = 10,\ ab = 20$)

SOHCAHTOA:

$sin = \frac{opposite}{hypotenuse}$

$cos = \frac{adjacent}{hypotenuse}$

$tan = \frac{opposite}{adjacent}$

Other Formulas

Quadratic Formula: $\frac{-b \pm \sqrt{b^2-4ac}}{2a}$

Simple Interest Formula:
$I = PRT\ (P = Investment,\ R = Interest\ Rate,\ T = Time)$

Interquartile Range (IQR):
$IQR = Q_3 - Q_1\ (Q_1 = Quartile\ 1,\ Q_3 = Quartile\ 3)$

Outlier Formula:
$Q_3 + 1.5(IQR)$
$Q_1 - 1.5(IQR)$

Permutation (Order Matters) Formula:
$nPr = \frac{n!}{(n-r)!} \quad (n = total\ \#\ of\ objects,\ r = chosen\ \#\ of\ objects)$

Combination (Order Doesn't Matter) Formula:
$nCr = \frac{n!}{r!(n-r)} \quad (n = total\ \#\ of\ objects,\ r = chosen\ \#\ of\ objects)$

Center of a Circle:
$(x - h)^2 + (y - k)^2 = r^2$

Work Word Problems:

$\frac{T}{A} + \frac{T}{B} = 1$

Percentage Formula:

$$\frac{part}{whole} = \frac{\%}{100}$$

Percentage Change Formula:

$$\%\ Change = \frac{Change}{Original} \cdot 100$$

Arithmetic Sequence:

$a_n = a_1 + (n-1)\,d$ $\quad (a_n = n^{th}\ number\ in\ the\ sequence,\ a_1 = 1st\ numb$

$sequence,\ d = common\ difference,\ n = position\ of\ number\ in\ the\ sequence)$

Geometric Sequence:

$a_n = a_1 \cdot r^{n-1}$ $\quad (r = common\ ratio)$

Mean of Consecutive Numbers:

$\frac{a+b}{2} (a = first\ number,\ b = last\ number)$

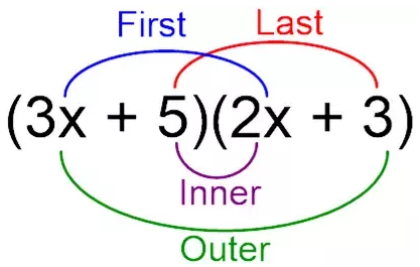
Distance and Rate Formulas:

$d = r \cdot t$ $\quad (d = distance,\ r = rate,\ t = time)$

$d_1 = d_2$ $\quad (d_1 = person\ 1,\ d_2 = person\ 2)$

Multiplying Polynomials remember:

First Outer Inner Last



Order of Operations remember:
Parenthesis Exponents (Multiplication Division) (Addition Subtraction)
(left to right) (left to right)

🆙 "How to get better at ELA?" 🆙
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ELA TOPICS: ■ Grammar, syntax, semantics, formal, style ■ Sentences/predicates, Incomplete sentences/fragments, Run-on sentences ■ Prepositional phrases, transitions, FANBOYS et al, ■ Transitions/conjunctions Independent/dependent clauses, Dangling participles/Phrase proximity ■ Modifiers, misplaced/dangling ■ Concise/precise/ redundancy, Subject-verb agreement, Tenses ■ Verbs/actions ■ Pronoun use, Agreement ■ Commas, Colons, Semicolons, Dashes ■ Apostrophes, Contractions ■ Possession ■ Homophones ■ Quotations (using and reading) ■ Singular/plural ■ Passive/active voice, comparative/superlative ■ Parallelisms ■ Phrase Redundancy/inclusion/exclusion ■ Who/ whom ■ They/them ■ Spelling, Punctuation ■ Revising/Editing ■ Information/Research ■ Using illustrations ■ Vocabulary [in context] ■ Analogies, Synonyms ■ Author's craft ■ Main idea/theme/setting/character traits ■ Passage summary ■ Main idea support ■ Author's purpose, Author's point of view. ■ Un/important details ■ Inferencing ■ Poetry and other genres ■ Sequencing, organization, flow, etc. ■ Passage summary versus comprehension vs deep comprehension ■ Cause and effect ■ Compare and contrast ■ Facts vs Opinion vs Argument ■ Evidence/reasoning/persuasion/correlations ■ Who/what/ where/when/why ■ Making arguments, Support arguments, Similar vs different arguments In passages. In your own writing. ■ Drawing conclusions ■ Interpreting information ■ Idioms, cliches, metaphor, simile

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SHSAT Formulas/rules You Should Know
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This is mostly the Grade 8 ones that come up often:
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* degrees in closed polygons
* perimeter, circumference, various areas, 2D shapes
  circles, squares, rectangles, triangles, trapezoids, etc.
* Pythagorean
* using pi
* coordinates, slope, representation of a line, midpoint, number line
* using "PEMDAS" (including square root, absolute value ordering)
* roots and exponents
* solving simultaneous equations
* rates, proportions, ratios, similarities
* Cross product aka "butterfly technique"
* absolute value, interest, discounts, taxes, percents, probability
* distance, rate, speed, velocity, revolutions
* conversions
* centralities (min, max, range, mean, median)
* prime factorizations, LCM, GCF
* angle interactions, lengths of sides interactions
* like terms
* Odd and even number interactions
* interactions with + and − during
   addition/subtraction, multiplication/division,
   exponents, roots, translations, number line
* Conversion from whole numbers/mixed numbers,
  fractions/decimals/rounding/estimating/scientific notation

This is mostly the Grade 9 ones that come up often:
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* factorials, permutations, combinations
* polynomials
* 3D shapes and various volumes
  cubes, cylinders, spheres, cones, pyramids, prisms, etc.
* inequalities
* FOIL
* translations
* knowing quadratic formula can be helpful
* knowing SOHCAHTOA can be helpful

NOTE: Many of these float across both years
NOTE: The DOE does not provide any such lists,
      so this document is based on many years of observations
NOTE: This is a sampling only, the DOE can add more as they wish

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